IN THE CLAIMS:

1-44. (Cancelled)

45. (New) A method of causing non-spontaneous and controlled differentiation of an undifferentiated stem cell into a mesodermal cell, said method comprising:

applying a differentiation signal to the undifferentiated stem cell wherein the differentiation signal induces the differentiation of the undifferentiated stem cell into the mesoderm cell.

46. (New) A method of obtaining a cell population comprising a sub-population of differentiated cells of a mesodermal lineage wherein the differentiated cells are derived from undifferentiated stem cells in the cell population, said method comprising:

causing differentiation of the undifferentiated stem cells according to claim 45.

47. (New) A method according to claim 45 or 46 wherein the differentiation signal is applied by culturing the undifferentiated stem cells in the presence of an influencing factor that can induce differentiation of the stem cell.

48. (New) A method according to claim 47 wherein the influencing factor is selected from embryonic cells and extracellular factors including growth factors, cytokines and small molecules that regulate and trigger differentiation secreted from embryonic cells.

49. (New) A method according to claim 48 where the embryonic cell is an endodermal or ectodermal cell.

50. (New) A method according to claim 49 where the embryonic cell is an endodermal cell.

51. (New) A method according to claim 49 wherein the cell is derived from visceral endoderm tissue, or visceral endoderm-like tissue.

52. (New) A method according to claim 51 wherein the visceral endoderm or visceral endoderm-like tissue is derived from an early post-gastrulation embryo.

53. (New) A method according to claim 51 wherein the visceral endoderm-like tissue is an embryonic cell line.

54. (New) A method according to claim 53 wherein the embryonic cell line is an END-2 cell line.

55. (New) A method according to claim 48 wherein the embryonic cell is derived from mouse embryo E7.5.

56. (New) A method according to claim 45 or 46 wherein the stem cell is selected from the group including embryonic stem cells, pluripotent stem cells, haematopoietic stem cells, totipotent stem cells, mesenchymal stem cells, neural stem cells, or adult stem cells.

57. (New) A method according to claim 56 wherein the stem cell is an embryonic stem cell.

58. (New) A method according to claim 56 wherein the stem cell is pluripotent.

59. (New) A method according to claim 45 or 46 wherein the stem cell is human.

60. (New) A method according to claim 45 or 46 further comprising:

preculturing the embryonic cell to a substantially confluent monolayer; and

co-culturing the stem cell in the presence of the embryonic cell monolayer and/or extracellular media of the embryonic cell monolayer.

61. (New) A method according to claim 60 wherein the stem cell and embryonic cell monolayer are separated by a filter or a cellular matrix.

62. (New) A method according to claim 45 or 46 wherein the undifferentiated stem cell differentiates into a cell or a cell lineage selected from the group including muscle cells, endothelial cells, epithelial cells, haematopoietic cells or neural cells.

63. (New) A method according to claim 62 wherein the stem cell differentiates to a muscle cell or a vascular endothelial cell.

64. (New) A method according to claim 63 wherein the muscle cell is a cardiomyocyte or a skeletal muscle cell.

65. (New) A method according to claim 64 wherein the stem cell differentiates to a cardiomyocyte or a cardiomyocyte cell lineage said method comprising:

applying the differentiation signal by culturing the stem cell in the presence of an embryonic visceral endoderm cell and/or extracellular medium of an embryonic visceral endoderm cell.

66. (New) A method according to claim 64 wherein the stem cell differentiates to a skeletal muscle cell or skeletal muscle cell lineage said method comprising:

applying the differentiation signal by culturing the stem cell in the presence of an embryonic ectoderm cell and/or extracellular medium of an embryonic ectoderm cell.

67. (New) A method according to claim 64 wherein the stem cell differentiates to a vascular endothelial cell or vascular endothelial cell lineage, said method comprising:

applying the differentiation signal by culturing the stem cell in the presence of an embryonic ectoderm and/or endoderm cell, and/or extracellular medium of an embryonic, ectoderm and/or endoderm cell.

68. (New) A method according to claim 67 wherein the ectoderm and/or endoderm tissue is extraembryonic.

69. (New) A method according to claim 68 further including culturing the stem cells in the presence of VEGF.

70. (New) A method according to claim 45 or 46 wherein the stem cell is genetically modified.

71. (New) A method according to claim 46 wherein the sub population consists essentially of cardiomyocytes.

72. (New) A method according to claim 46 wherein the sub population consists essentially of skeletal muscle cells.

73. (New) A method according to claim 46 wherein the sub population consists essentially of vascular endothelial cells.

74. (New) An isolated cell population comprising a sub-population of differentiated cells of a cell lineage wherein the differentiated cells are derived from undifferentiated stem cells within the cell population.

75. (New) An isolated cell population according to claim 74 wherein the subpopulation of differentiated cells is greater than 5% in the cell population.

76. (New) An isolated cell population according to claim 74 or 75 consisting essentially of a sub population of differentiated cells of a cell lineage.

77. (New) An isolated cell population according to claim 74 or 75 wherein the sub-population of differentiated cells is selected from the group including muscle cells, endothelial cells, epithelial cells, haematopoietic cells or neural cells.

78. (New) An isolated cell population according to claim 74 or 75 wherein the sub-population of differentiated cells consists essentially of muscle or vascular endothelial cells.

79. (New) An isolated cell population according to claim 78 the muscle cells are cardiomyocyte or skeletal muscle cells.

80. (New) An isolated cell population according to claim 79 wherein the muscle cells are cardiomyocytes.

81. (New) An isolated cell population according to claim 79 wherein the muscle cells are skeletal muscle cells.

82. (New) An isolated cell population according to claim 78 wherein the sub-population of differentiated cells consists essentially of vascular endothelial cells.

83. (New) An isolated cell population according to claim 74 or 75 wherein the stem cells are selected from the group including embryonic stem cells, pluripotent stem cells, haematopoietic stem cells, totipotent stem cells, mesenchymal stem cells, neural stem cells, or adult stem cells.

84. (New) An isolated cell population according to claim 74 or 75 wherein the stem cells are embryonic stem cells.

85. (New) An isolated cell population according to claim 74 or 75 wherein the stem cells are pluripotent.

86. (New) An isolated cell population according to claim 74 or 75 wherein the stem cells are human.

87. (New) An isolated cell population prepared by the method according to claim 46.

88. (New) A differentiated cell prepared by a method according to claim 45 or 46.

89. (New) A cardiomyocyte prepared by the method according to claim 65.

90. (New) A skeletal muscle cell prepared by the method according to claim 66.

91. (New) A vascular endothelial cell prepared by the method according to claim 67.

92. (New) An isolated factor that causes specific differentiation of a stem cell said factor derived from an embryonic cell or extracellular medium of a cultured embryonic cell.

93. (New) A factor according to claim 92 wherein the embryonic cell is an endodermal or ectodermal cell.

94. (New) A factor according to claims 92 or 93 wherein the embryonic cell is derived from visceral endoderm tissue, or visceral endoderm-like tissue.

95. (New) A factor according to claim 94 wherein the visceral endoderm or visceral endoderm-like tissue is derived from an early postgastrulation embryo.

96. (New) A factor according to claim 94 wherein the visceral endoderm-like tissue is an embryonic cell line.

97. (New) A factor according to claim 96 wherein the embryonic cell line is the END-2 cell line.

98. (New) A factor according to claim 92 or 93 wherein the embryonic cell is derived from mouse embryo E7.5.

99. (New) A factor according to claim 92 or 93 wherein the factor is derived from ectoderm tissue.

100. (New) A factor according to claim 92 or 93 wherein the factor is derived from endoderm and ectoderm tissue.

101. (New) A factor according to claim 100 wherein the ectoderm tissue and endoderm tissue is extraembryonic.

102. (New) A method of causing differentiation of a stem cell to a cell lineage, said method including culturing the stem cell in the presence of the factor according to claim 92 or 93.

103. (New) A method of causing differentiation of a stem cell to a cell lineage, said method including culturing the stem cell in the presence of the factor according to claim 99.

104. (New) A method of causing differentiation of a stem cell to a cell lineage, said method including culturing the stem cell in the presence of the factor according to claim 100.

105. (New) A differentiated cell prepared by the method according to claim 102.

106. (New) A cardiomyocyte prepared by the method according to claim 102.

107. (New) A skeletal muscle cell prepared by the method according to claim 103.

108. (New) A vascular endothelial cell prepared by the method according to claim 104.

109. (New) A method of treating or preventing a cardiac disease or condition in a patient, said method comprising:

introducing to the patient an isolated cell population according to claim 74, and/or a progenitor in the cell population.

110. (New) A method according to claim 109 wherein the isolated cell population consists essentially of cardiomyocytes or a cardiomyocyte progenitors.

111. (New) A method according to claim 110 wherein the cardiomyocyte or cardiomyocyte progenitor is derived from co-culturing a stem cell in the presence of embryonic visceral endoderm cells and/or extracellular medium of embryonic visceral endoderm cells.

112. (New) A method according to claim 109 wherein the cardiac disease or condition is selected from the group including myocardial infarction, or cardiac hypertrophy.

113. (New) A method of repairing damaged cardiac tissue, said method comprising:

introducing to the damaged cardiac tissue, an isolated cell population according to claim 74 and/or a progenitor in the cell population.

114. (New) A method according to claim 113 wherein the isolated cell population consists essentiallyof cardiomyocytes or a cardiomyocyte progenitors.

115. (New) A method according to claim 114 wherein the cardiomyocyte or cardiomyocyte progenitor is derived from co-culturing a stem cell in the presence of embryonic visceral endoderm cells and/or extracellular medium of embryonic visceral endoderm cells.

116. (New) A method according to claim113 wherein the damaged cardiac tissue results from cardiac ischaemia.

117. (New) A method of treating or preventing muscle disease in a patient, said method comprising:

introducing to the muscle of the patient, an isolated cell population according to claim 74 and/or a progenitor in the cell population

118. (New) A method according to claim 117 wherein the isolated cell population consists essentially of skeletal muscle cells or a skeletal muscle cell progenitors.

119. (New) A method according to claim 118 wherein the skeletal muscle cell is derived from a co-culture of a stem cell in the presence of embryonic ectoderm cells and/or extracellular medium of embryonic ectoderm cells.

120. (New) A method according to claim 117 wherein the muscle disease is muscular dystrophy.

121. (New) A method of treating or preventing a vascular disease in vascular tissue, said method comprising:

introducing to the vascular tissue, an isolated cell population according to claim 74 and/or a progenitor cell in the cell population that has been co-cultured in the presence of an embryonic ectoderm and/or endoderm cell and/or extracellular medium of an embryonic ectoderm and/or endoderm cell.

122. (New) A method according to claim 121 wherein the isolated cell population comprises a vascular endothelial cell or a vascular endothelial cell progenitor.

123. (New) A method according to claim 122 wherein the vascular endothelial cell or vascular endothelial cell progenitor cell is derived from a co-culture of a stem cell in the presence of embryonic ectoderm cells and/or endoderm cell, and/or extracellular medium of embryonic ectoderm cells and/or endoderm cells.

124. (New) A method according to claim 127 wherein the vascular disease is selected for the group including hereditary hemorrhagic telangiectasia, vascular deterioration as a result of diabetes or smoking.

125. (New) A model for testing suitability of a cardiomyocyte cell for cardiac transplantation, said model comprising:

an immunodeficient animal having a measurable parameter of cardiac function wherein said animal is capable of receiving by a cardiomyocyte or cardiomyocyte progenitor according to claim 89 by transplantation; and

a means to determine cardiac function of the animal before and after transplantation of the cardiomyocyte.

126. (New) A model according to claim 125 wherein the immunodeficient animal is created as a model of cardiac muscle degeneration following infarct.

127. (New) A model according to claim 125 wherein the parameter of cardiac function is contractile function.

128. (New) A cardiomyocyte selected for cardiac repair as determined by the model according to claim 125.

129. (New) An *in vitro* stem cell derived cardiomyocyte.

130. (New) A cardiomyocyte derived by directed differentiation of stem cells.

131. (New) A cardiomyocyte according to claim 130 wherein the stem cell is an embryonic stem cell.

132. (New) A cardiomyocyte according to claim 129 or 130 wherein the stem cell is a human embryonic stem cell.